

ABSTRACT

A transistor-type ferroelectric nonvolatile memory element having an MFMIS (metal-ferroelectric-metal-insulator-semiconductor) structure that can be highly densely integrated. The MFMIS transistor has a constitution in which the MFM (metal-ferroelectric-metal) structure and the MIS (metal-insulator-semiconductor) structure are stacked up and down on nearly the same area, and the lower MIS structure has means for increasing the effective area of the MIS capacitance. Means for increasing the effective area of the capacitor is a trench in the semiconductor substrate, ruggedness in the MIS structure or a MIM (metal-insulator-metal) structure.